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TWO NEW SCORPIONFISHES (GENUS
SCORPAENODES) FROM THE INDO-WEST
PACIFIC, WITH COMMENTS ON
SCORPAENODES MUCIPARUS (ALCOCK)

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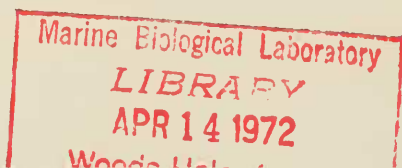
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ABSTRACT: Two new scorpionfishes of the genus *Scorpaenodes* are described from the Indian Ocean. Additional comments are given on *Scorpaenodes muciparus* (Alcock). These three species are compared with each other and with *S. tribulosus* Eschmeyer, the fourth species of the genus *Scorpaenodes* known from offshore areas in the Indo-West Pacific.

INTRODUCTION

Eschmeyer (1969a) identified Indian Ocean specimens collected by the United States International Indian Ocean Expedition as *Scorpaenodes muciparus* (Alcock, 1889), offering a description and figures. Recently, we had the opportunity to examine two specimens of *S. muciparus* in the collection of the Zoological Survey of India, and one of us (W.N.E.) was also able to examine the specimen collected by the *Siboga* which was identified as *S. muciparus* by Weber (1913) and also by de Beaufort (Weber and de Beaufort, 1962). It was then apparent that the specimens identified by Eschmeyer (1969a) as *S. muciparus* were not specimens of that species but represented a new species, a species which one of us (K.V.R.R.) was in the process of describing as part of current studies on the



scorpionfishes of India. Examination of scorpionfishes in other museums has resulted in location of yet another closely related species, the description of which we include in this paper. These three species, along with *S. tribulosus* (Eschmeyer, 1969a), live in offshore level-bottom areas, while other members of the genus are shallow-water rock or reef inhabitants.

ACKNOWLEDGMENTS

The senior author acknowledges the support of National Science Foundation Grant GB-15811, which permitted him to examine scorpionfishes in most of the major fish collections. The following museums contained specimens used in this study, and we wish to thank the curators and staffs listed for courtesies extended during his visits to their museums: BMNH, British Museum of Natural History (N. B. Marshall, G. Palmer, A. Wheeler, P. Whitehead); CAS, California Academy of Sciences (L. Dempster, P. Sonoda); NMS, National Museum of Singapore (E. Alfred); USNM, United States National Museum (N. Gamblin, V. Springer); ZMA, Zoological Museum, Amsterdam (H. Nijssen); ZMC, Zoological Museum, Copenhagen (J. Nielsen); ZSI, Zoological Survey of India (A. G. K. Menon).

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METHODS

Counts, measurements, and terminology of head spines are as used by Eschmeyer (1969b, pp. 4-6).

SPECIES ACCOUNTS

The limits of the genus *Scorpaenodes* have been discussed recently (Eschmeyer, 1969a). Within the subfamily Scorpaeninae, the genus is characterized by the following combination of characters: normally thirteen dorsal spines, spinous procurent caudal fin rays, and no palatine teeth. The genus contains species which are primarily tropical, shallow-water forms, and species of the genus are found in all warm oceans.

The four species of *Scorpaenodes* treated in the present paper are the only ones of the genus occurring in offshore Indo-Pacific waters below a depth of about 20 fathoms. These four species may be separated as follows:

1. Vertical scale rows (above lateral line from first lateral line scale to end of hypural)
70 or more *S. muciparus*
1. Vertical scale rows about 50 or fewer 2
2. Soft dorsal rays $8\frac{1}{2}$, scales strongly ctenoid with long ctenii, underside of head covered
with ctenoid scales *S. tribulosus*

2. Soft dorsal rays usually $9\frac{1}{2}$, scales ctenoid, underside of head naked or with cycloid scales 3
3. Pectoral rays usually 17-18; rear of the buccal cavity pallid *S. smithi*, new species
3. Pectoral rays usually 19 (18-20); rear of the buccal cavity dusky *S. investigatoris*, new species

REMARKS. A new species, *Scorpaenodes steinitzi*, was described recently by Klausewitz and Frøiland (1970) from the Red Sea. Seventy-five additional specimens of this species are available to us. Two of the major differentiating characters used by these authors were that the dorsal and anal soft ray counts were 1 higher in *S. steinitzi* than in the other species, but this results from the fact that Klausewitz and Frøiland counted the last double ray as 2 rays, while recent authors count this as 1 or $1\frac{1}{2}$ rays. Despite this, *Scorpaenodes steinitzi* appears to be a valid species which is distinguishable from other species most easily by its coloration. We mention this because readers may wonder if *S. steinitzi* might not be one of the species treated here by us. *Scorpaenodes steinitzi* is a pale-colored species with some brown pigment on the sides and it usually has a dark spot near the posterior end of the spinous dorsal fin, but *S. steinitzi* does not have the lateralis canal head pores well developed and it is a shallow-living species. In *S. steinitzi* the spots on the caudal fin when present are arranged in rows while they are more scattered in *S. smithi*; and the dark pigment on the sides in *S. steinitzi* is not arranged in definite bars as in *S. smithi*, *S. investigatoris*, and *S. muciparus*.

***Scorpaenodes investigatoris* Eschmeyer and Rama Rao, new species.**

Scorpaenodes muciparus, ESCHMEYER, 1969a, pp. 4-8, figs. 1a, b, table 1 (description; these specimens now referred to this new species, not *S. muciparus* (Alcock, 1889).

Scorpaenodes varipinnis, SMITH, 1957, p. 65 (in part; only the 50 mm. specimen taken from the stomach of a specimen of *Pristipomoides microlepis* Bleeker collected in 110 fathoms off Memba and tentatively referred to *S. varipinnis*).

REMARKS. The specimens wrongly identified by Eschmeyer (1969a) as *S. muciparus* (Alcock) are designated as the types of this new species along with two specimens from the collection of the Zoological Survey of India. The holotype (CAS 24264) and one paratype (CAS 24265) were figured by Eschmeyer (1969a, fig. 1a, b).

TYPE MATERIAL. *Holotype*. CAS 24264 (1, 71.2 mm. S.L.), West Pakistan, $24^{\circ}13' N.$, $65^{\circ}52' E.$, in 93 fathoms, *Anton Bruun* Cruise 4B, station 267B, 9 December 1963.

Paratypes. CAS 24266 (1, 87.4 mm. S.L.), West Pakistan, $25^{\circ}02' N.$, $56^{\circ}52' E.$, in 159 fathoms, *Anton Bruun* Cruise 4B, station 264A, 2 December 1963; CAS 24265 (2, 45.8-48.9 mm. S.L.), off western India, $22^{\circ}32' N.$, $68^{\circ}07'$

E., in 31.5 fathoms, *Anton Bruun* Cruise 4B, station 221A, 18 November 1963; USNM 204030 (1, 72.4 mm. S.L.), off western India, $17^{\circ}25' \text{ N.}$, $71^{\circ}39' \text{ E.}$, in 52.5 fathoms, *Anton Bruun* Cruise 4B, station 202A, 13 November 1963; ZSI 916/1 (1, 86 mm. S.L.) and ZSI 917/1 (1, 67 mm. S.L.), Arabian Sea, off Ratnagiri Coast, $17^{\circ}27' \text{ N.}$, $71^{\circ}41' \text{ E.}$, 56–58 fathoms, bottom of fine sand, Agassiz trawl haul, *Investigator* station 242, 11 October 1898. (Smith's specimen mentioned above in the Synonymy is regarded only as an additional specimen and not a type.)

DESCRIPTION. See Eschmeyer (1969a, pp. 4–8, figs. 1a and 1b, table 1) for a complete description of this species. The two ZSI specimens have the following counts: Dorsal rays XIII, $9\frac{1}{2}$ anal rays III, $5\frac{1}{2}$ – $6\frac{1}{2}$; pectoral rays 19. The vertical scale rows in the two specimens number 45–48, and the gill rakers number 5–6 plus 12–13. Except for the specimen with $6\frac{1}{2}$ soft anal rays, the counts fall within those given by Eschmeyer (1969a, table 1).

DISTRIBUTION. *Scorpaenodes investigatoris* is known from the Gulf of Oman and in the Arabian Sea off western India and West Pakistan. The specimen reported by Smith (1957, p. 65) was taken off Memba, Mozambique. Depths of capture range from 31 to 159 fathoms.

COMPARISONS. This species very closely resembles *Scorpaenodes smithi* in scalation, counts, and coloration. *Scorpaenodes investigatoris* and *S. smithi* may be easily separated from the other two offshore species of *Scorpaenodes*: *S. muciparus* has over 70 vertical scale rows as opposed to about 50 in *S. investigatoris* and *S. smithi*, and *S. tribulosus* has strongly ctenoid scales on the underside of the head while the other species have the underside of the head mostly naked or with cycloid scales. The descriptions of *S. investigatoris* and *S. smithi* are almost identical. The two characters which may be used to separate them are pectoral rays and the coloration of the rear of the buccal cavity. In *S. investigatoris* the pectoral rays are usually 19 (18–20) while they usually number 17 or 18 (16–19) in *S. smithi*. In *S. investigatoris* the rear of the mouth, including the pharyngeal bones and the areas adjacent to them, is dusky in coloration while this area is pallid in *S. smithi*. No other clear-cut differences were noted. *Scorpaenodes investigatoris* appears to live at deeper depths than *S. smithi*.

ETYMOLOGY. The name is based on the Royal Marine Survey Steamer *Investigator*, which made important collections in the Indian Seas during the years 1884–1926; the name “*investigatoris*” was used by one of us (K.V.R.R.) for this species in his unpublished thesis on Indian Ocean scorpionfishes.

Scorpaenodes muciparus (Alcock).

Sebastes muciparus ALCOCK, 1889, pp. 298–299, fig. 3 on pl. 22 (original description; type locality Bay of Bengal, 26 miles N. by E. of Gopalpur, in 45 fathoms). ALCOCK, 1898, pl. 18, fig. 5 (good illustration). WEBER, 1913, p. 491 (brief description; one from Siboga station 306, Solor Straits, $8^{\circ}27' \text{ S.}$, $122^{\circ}54' \text{ W.}$, in 247 meters).

Scorpaenodes muciparus, de Beaufort in WEBER and DE BEAUFORT, 1962, pp. 34–35 (redescription of *Siboga* specimen described by Weber).

MATERIAL EXAMINED. ZSI 1179/1 (1, 80 mm. S.L.) Gulf of Martaban, 14°46'N., 95°52'E., in 61 fathoms, on soft, green muddy and sandy bottom, Agassiz trawl haul, *Investigator* station 328, 7 March 1904; ZSI 12432 (1, 73 mm. S.L.) Bay of Bengal, Ganjam coast, 19°24'N., 85°E., in 23 fathoms, muddy bottom, Blake trawl haul, *Investigator* station 42, 7 March 1889; ZMA 110.246 (1, 146 mm. S.L.) Indonesia, Solor Straits, 8°27'S., 122°54'E., in 135 fathoms, *Siboga* station 306, 8 Feb. 1900.

REMARKS. The reader is referred to the references listed above for a more complete description of this species. The holotype of this species, which was originally in the ZSI collection, has been lost. If a neotype is ever needed, we suggest that the specimen listed above from *Investigator* station 42 (ZSI 12432) would make the best neotype, as it is from the same general locality as the type and was identified as *S. muciparus* by Alcock. *Scorpaenodes muciparus* is characterized by a dorsal ray count of 13 spines and 9½ soft rays, pectoral rays of 18–19, and vertical scale rows of over 70. The other three species treated in this paper have a scale count of 50 or fewer. De Beaufort (in Weber and de Beaufort, 1962, p. 35) gives a scale count of 45–58 for the *Siboga* specimen. Re-examination shows that the specimen has a vertical scale row count of about 70–73 when the scale rows are counted above the lateral line from the supracleithral spine to the end of the hypural plate.

***Scorpaenodes tribulosus* Eschmeyer.**

Scorpaenodes tribulosus ESCHMEYER, 1969a, pp. 8–10, fig. 1c, table 1 (original description; type locality East Africa, off Kenya, 02°42'S., 40°53'E., in 77 fathoms and off the Somali Republic, 11°24'N., 51°35'E., in 40–96 fathoms).

REMARKS. The species is still known only from the western Indian Ocean, from the holotype (CAS 24267, off Kenya) and one paratype (USNM 204031, off the Somali Republic) as given above. The reader is referred to Eschmeyer (1969a) for a description of this species. This species is characterized by a dorsal ray count of 13 spines and 8½ soft rays, pectoral rays 19, and vertical scale rows under 50. *Scorpaenodes tribulosus* is most easily distinguished from the other species by the presence of strongly ctenoid scales on the underside of the head; the other three species have this area covered with cycloid scales or mostly naked.

***Scorpaenodes smithi* Eschmeyer and Rama Rao, new species.**

(Figure 1.)

TYPE MATERIAL. *Holotype.* BMNH 1929.6.12.6 (52.2 mm. S.L.), Andaman Sea, off western Malaya, 5°45'N., 98°20'E., in 40 fathoms, Madras- Penang Cable Survey, Cable ship *Patrol*, 16 March 1929.

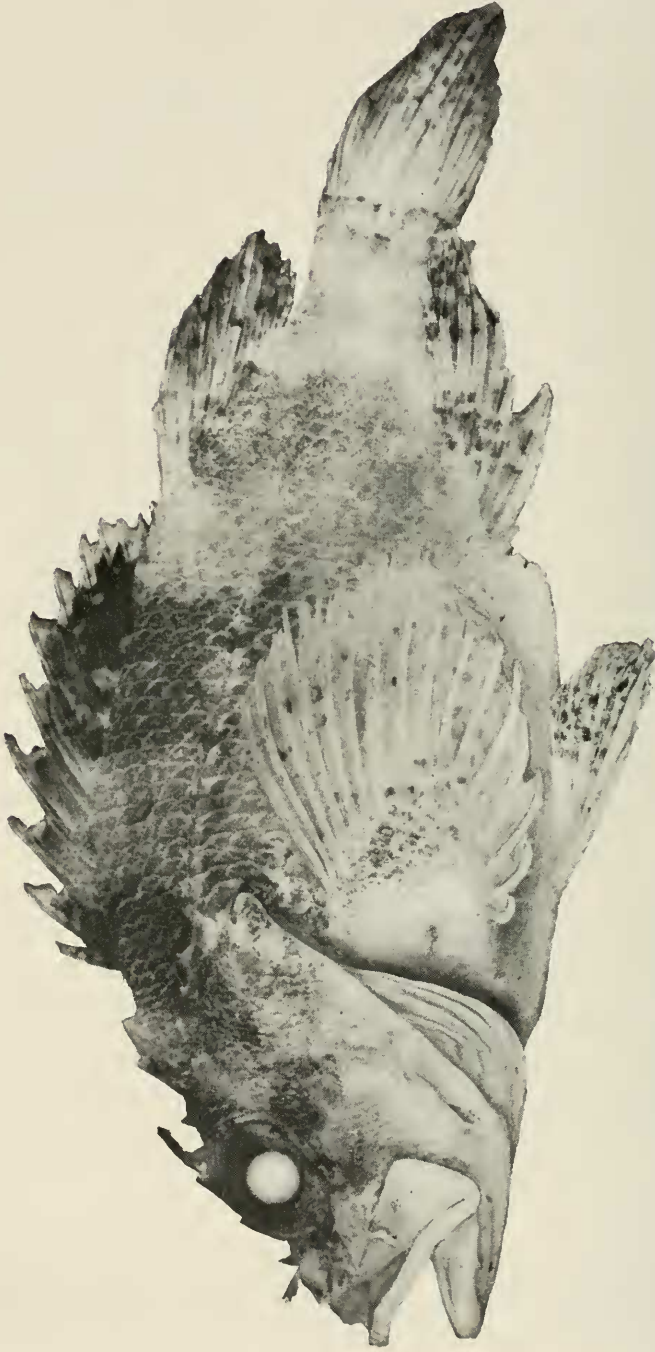


FIGURE 1. *Scorpaenodes smilhi* Eschmeyer and Rama Rao, new species; holotype, BMNH 1929.6.12.6, 52.2 mm. S.L., from the Andaman Sea.

Paratypes. BMNH1929.6.12.7–15 (12, 21.5–47.0 mm. S.L.), and CAS 13616 (4, 23.2–52.1 mm. S.L.) and ZSI F6254/2 (1, 46.0 mm. S.L.), formerly in BMNH 1929.6.12.6–15, taken with the holotype; BMNH 1932.2.15.15–20 (6, 24.5–48.3 mm. S.L.), Andaman Sea, west of Malaya, 6°01'20"N., 99°03'05"E., in 46 fathoms, mud bottom, Madras-Penang Cable Survey, no date; BMNH 1972.1.17.1–9 (9, 22.0–51.3 mm. S.L.) and USNM 206501 (4, 22.4–45.6 mm. S.L.) west of Malaya, 80 miles south of Penang, in 24 fathoms, entangled in coelenterates found on cable, cable ship *Patrol*, May 1923; BMNH 1933.8.11.4 (1, 35.6 mm. S.L.), Arafura Sea, 11°59'30"S., 126°38"E., in 60 fathoms, E. and A. Telegraph Company, collected in or before 1933; ZMC P7982–83 (2, 56.5 mm. S.L.), Gulf of Tonkin, 20°26'N., 108°09'E., in 28 fathoms, collected by Schønau in or before 1895; ZMC P7978–81 (4, 46.2–60.8 mm. S.L.), China Seas, collected by E. Svenson, in or before 1893; ZMC P79100–112 (13, 34.0–62.4 mm. S.L.), southwest of Hong Kong, 26°10'N., 121°00'E., in 44 fathoms, collected by H. Christiansen, 31 May 1912; ZMC P79113–132 (20, 28.7–46.8 mm. S.L.), off western Malaya, 5°09'08"N., 99°48'10"E., in 32 fathoms, sandy mud bottom, collected by Store Nordiske, 24 Dec. 1935; ZMC P7991–92 (2, 32.1–58.8 mm. S.L.), Formosa Strait, "Namoa" Island, collected by Capt. Svenson, in or before 1912; NMS uncataloged (10, 15.5–54.4 mm. S.L.), near Singapore 5°59'06"N., 99°08'33"E., in 40 fathoms, collected by Tweedie. A total of 89 specimens.

DESCRIPTION. Measurements and counts summarized in table 1; body shape and coloration in figure 1.

Dorsal fin rays normally XIII, 9½, rarely 8½ or 10½. Anal fin rays normally III, 5½. Pectoral rays usually 17 or 18 (16–19), rays 2 or 3 through 7 to 9 branched in larger specimens; smaller specimens with fewer branched rays; the branching of pectoral rays begins at about 25–30 mm. S.L. Spines on head well developed. Preorbital bone with second and third lobes (Matsubara's, 1943, terminology) each as a broad spinous point extending over the maxillary, third lobe usually with additional spinous points; suborbital ridge with one row of spinous points, usually one and sometimes several spines on the lateral face of the preorbital bone in line with three or more spinous points on the suborbital bones, the posterior one frequently double. Tympanic spines present; coronal spines usually absent, sometimes present only on one side, rarely present on both sides. Interorbital ridges rarely ending in spines. Small spines (postfrontal spines of Smith, 1957) near midline between tympanic spines sometimes present. Supplemental preopercular spine present. First preopercular spine long, second usually small, third present, fourth usually present, points ventrally, and fifth points down (sometimes virtually absent). Preocular, supraocular, and postocular spines well developed. Small spine below parietal spine usually absent. Other spines present include the nasal, parietal, nuchal, sphenotic, pterotic, upper (some-

TABLE 1. *Counts¹ and measurements of type specimens of Scorpaenodes smithi.*
(Measurements are in millimeters; numbers in parentheses are percentages of standard length.)

	<i>BMNH</i> <i>1929.6.12.6</i>		<i>CAS 13616</i>			<i>P7982-3</i>	
Standard length	52.2	52.1	48.7	44.2	23.2	56.5	56.5
Dorsal fin rays ¹	XIII+8½	XIII+9½	XIII+9½	XIII+9½	XIII+9½	XIII+9½	XIII+8½
Anal fin rays ¹	III+5½	III+5½	III+5½	III+5½	III+5½	III+6½	III+5½
Pectoral fin rays ¹	17+18	18+17	18+18	18+18	18+18	18+18	18+18
Head length	22.6(43)	23.3(45)	21.2(44)	19.1(43)	10.7(46)	24.3(43)	22.0(39)
Snout length	6.1(12)	6.5(12)	6.2(13)	5.2(12)	2.7(12)	6.5(12)	6.2(11)
Orbit diameter	6.8(13)	6.8(13)	6.7(14)	5.9(13)	3.2(14)	6.2(11)	6.7(12)
Interorbital width	3.3(06)	3.0(06)	2.8(06)	2.9(06)	1.7(07)	3.8(07)	3.2(06)
Upper jaw length	11.9(23)	13.0(25)	11.6(24)	9.7(22)	5.3(23)	12.4(22)	12.2(22)
Predorsal-fin length	20.7(40)	21.4(41)	20.0(41)	18.3(41)	10.3(44)	21.0(37)	20.4(36)
Body depth	22.2(43)	21.5(41)	19.6(40)	17.0(38)	9.9(43)	22.7(40)	22.0(39)
Pectoral fin length	17.2(33)	19.1(37)	16.5(34)	15.8(36)	7.4(32)	19.2(34)	21.5(38)
Pelvic fin length	13.9(27)	13.7(26)	12.6(26)	11.5(26)	5.7(24)	14.2(25)	14.8(26)
Caudal fin length	14.8(28)	14.4(28)	13.6(28)	12.3(28)	7.0(30)	14.8(26)	15.3(27)
	<i>ZSI F6254/2</i>		<i>BMNH 1932.2.15.15-20</i>				
Standard length	46.0	48.3	46.6	48.1	47.8	32.2	24.5
Dorsal fin rays	XIII+9½	XII+10½	XIII+9½	XIII+9½	XIII+9½	XIII+9½	XIII+9½
Anal fin rays	III+5½	III+5½	III+5½	III+5½	III+5½	III+5½	III+5½
Pectoral fin rays	17+18	17+17	18+18	17+17	17+17	18+18	18+18
Head length	19.8(43)	21.5(44)	20.3(44)	19.8(41)	19.7(41)	14.2(44)	11.4(46)
Snout length	5.2(11)	5.7(12)	5.2(11)	5.5(11)	5.4(11)	4.2(13)	3.1(13)

(Table 1 Continued)

	<i>ZSI F6254/2</i>	<i>BMNH 1932.2.15.15-20</i>					
Orbit diameter	5.7(12)	6.0(12)	5.7(12)	5.9(12)	6.0(12)	4.1(13)	3.6(15)
Interorbital width	2.7(06)	3.2(07)	2.8(06)	3.0(06)	3.2(07)	2.2(07)	1.8(07)
Upper jaw length	10.0(22)	11.0(23)	10.5(22)	10.4(22)	10.3(22)	7.5(23)	6.2(25)
Predorsal fin length	18.8(41)	19.1(40)	18.6(40)	19.4(40)	19.0(40)	14.2(44)	11.2(46)
Body depth	19.0(41)	18.8(39)	18.8(40)	19.8(41)	20.0(42)	13.2(41)	10.6(43)
Pectoral fin length	14.6(32)	14.5(30)	14.4(31)	14.0(29)	14.4(30)	9.0(28)	7.7(31)
Pelvic fin length	12.2(26)	12.0(25)	12.5(27)	12.5(27)	11.5(24)	8.0(25)	7.0(28)
Caudal fin length	13.0(28)	12.4(26)	12.8(27)	12.9(27)	12.6(26)	8.6(27)	7.1(29)

¹ Counts of 63 additional specimens give the following totals (12 small specimens not counted): Dorsal fin rays XIII+9½ (70 specimens), XIII+8½ (2), XIII+9 (1), XII+10½ (1), XIII+10½ (2), and XIII+5½ (1, abnormal); Anal fin rays III+5½ (75 specimens), III+6½ (1), I+6½ (1, abnormal); Pectoral fin rays 16+17 (1 specimen), 17+17 (22), 17+18 (6), 18+17 (7), 18+18 (37), 18+19 (1), 19+18 (2), 19+19 (1).

times absent) and lower posttemporal, two opercular, cleithral, and supracleithral (double). Fourth suborbital bone isolated, bearing a few small spines (Ginsburg's, 1953, postorbital spines). Tentacles and other fleshy appendages associated with most head spines. Supraocular tentacle about ⅓ to ½ of orbit diameter, sometimes reduced, with branches distally. A few tabs on upper part of eye, two usually larger than the others. Scales on flanks ctenoid; vertical scale rows about 40 to 50, usually in middle forties; lateral-line scales usually 23 plus 1 or 2 on caudal fin. Bases of fins with a few scales. Scales on chest and pectoral fin base mostly cycloid. Dorsal parts of head scaled; underside of head unscaled or with cycloid scales; snout unscaled. Gill rakers including rudiments 15–17; upper arch with 5–6 short spiny rakers; lower arch with 9–10 rakers on ceratobranchial and usually 2 rudiments on hypobranchial. Small slit present behind fourth gill arch. Head pores well developed. Color pattern as in figure 1. Most conspicuous feature is the black spot on the posterior part of the spinous dorsal fin. Body usually with four broad bands, first under anterior dorsal spines, second under posterior spinous dorsal fin, third between soft dorsal fin and anal fin, fourth at base of caudal fin. All fins with brown or black spots. Three brown bars radiating from eye; first extends forward across preorbital bone, second below eye, and third extends down and back from posterior ventral part of eye.

DISTRIBUTION. *Scorpaenodes smithi* seems to be widespread in the area of

the South China Sea and through the Straits of Malacca into the Andaman Sea. A wider distribution in the Indo-Australian Archipelago is expected. Depths of capture range from 24 to 60 fathoms, and the bottom type appears to be mud or sand.

COMPARISONS. See the Comparisons section under the account of *Scorpaenodes investigatoris*.

ETYMOLOGY. We name this species in honor of the late Professor J. L. B. Smith for his noteworthy contributions to the knowledge of Indian Ocean scorpionfishes.

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